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Critical Foundations for Algebra



Massachusetts
Office of Public Instruction
www.doe.mass.gov



Preparation: Go through the whole module or the sections you are presenting and gather/organize all necessary materials.

Say:

Introduce yourself and the module

Media: None

Handout: None



Describe SLANT: Have participants locate this routine card in their materials

S = Sit up (good posture keeps you alert)

L = Lean forward (this shows interest to your speaker)

A = Ask questions (do this by raising your hand, putting the questions in your notes, and to yourself)

N = Nod your head (or else shake your head, or show your understanding or confusion in some other way)

T = Track your speaker (keep your eye on the speaker to take in important non-verbal clues and to stay alert and interested)

Give a quick reminder to have cell phones on silent mode

Discuss that conversations should be limited to partner or small group discussions as sidebar conversations can be distracting to those around you.

Go over when the scheduled breaks will be and where the restrooms are located.

No media
No handouts

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Response Cards

- Purpose
- Critical Foundations for Algebra poll



Ministry of Education
Office of Public Instruction

Preparation: Make response cards for participants to use (2-sided cards with Yes-No, Agree-Disagree, or Thumbs up/Thumbs down or green/red cardstock)

Say:

Today we will be using response cards as a way to solicit responses from each participant. You each have (say the type of response cards) at your tables to use as response cards. Many of you may already use these in your classroom, but let's talk quickly about how to use them.

I will ask a question or say a statement, if your response is “yes” or “agree” then you would show the green side, but if your response is “no” or “disagree” then you would show the red side when I signal you to respond.

I will drop my hand when I am ready for your responses (*demonstrate*)

So, let's try one. I love to eat smoked oysters. (*wait-then drop hand*)

Give feedback on wait time and responses-practice again if participants don't wait for your hand drop

Let's check background knowledge with a quick poll using these response cards. Remember to watch for my hand drop then you can show your response.

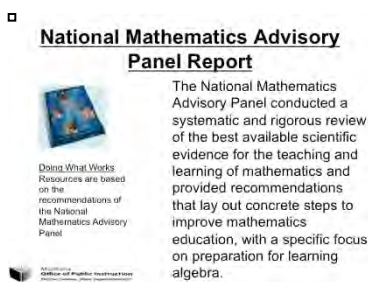
1-Teachers need be laying the foundations for algebra starting in fifth grade. (*Wait-Signal*) *No, they need to be built on from Kindergarten all the way through the elementary and middle school years.*

2-To build foundation for algebra teachers need to concentrate on key topics and be careful of the mile-wide inch deep curriculum. (*Wait-Signal*) *Yes, there are many skills needing attention, but not all of them deserve the same amount of time and attention. We need to teach the key topics well.*

3-Mathematics is different than reading-not everyone can be good at it. It really depends on IQ. (*Wait-Signal*) *No, there needs to be a cultural shift in the United States that values mathematics and expects that all students need to know and can learn mathematics.*

Well done with the response cards. You can see how we will be using them throughout the presentation. Keep them at arm's reach for use later.

Media: None



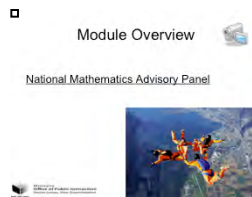
Preparation: None

The Panel worked in task groups and subcommittees to address areas of mathematics teaching and learning including Conceptual Knowledge and Skills, Learning Processes, Instructional Practices, Teachers and Teacher Education, and Assessment.

Five task groups carried out detailed syntheses of research evidence that addressed each group's major questions and met standards of methodological quality. Three subcommittees were charged with completion of a particular advisory function for the Panel. The research findings cited in these reports underpin the mathematics practices and content included on the Doing What Works website.

Media: None

Handout: None



Preparation: Download media

Say:

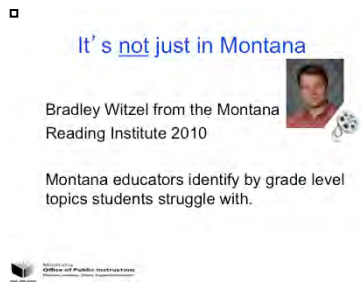
Watch this brief overview to learn about the purpose and findings of the National Mathematics Advisory Panel and research-based recommendations for improving mathematics instruction.

Find out why it's important for schools to focus on teaching critical mathematics skills to better prepare students for entry into algebra.

Ask: Why is it important for schools to focus on teaching critical mathematics skills to better prepare students for entry into algebra? (allow 1 min.)

Media: *National Mathematics Advisory Panel* Multimedia Overview (3:25 min.)

Handout: None



Preparation: Download video

Say:

In the summer of 2010 at the Montana Reading Institute-now known as the Montana Instructional Institute-Bradley Witzel presented to Montana educators on the topic of mathematics. He asked participants to write down, by grade level, the topics that Montana students struggle with.

Watch this video clip of what was identified as problematic. Toward the end of the clip Bradley Witzel asks participants if they hear some trends. See if you can identify trends that were identified. You may want to write down topics participants identify. (*Show video-4:50 min.*)

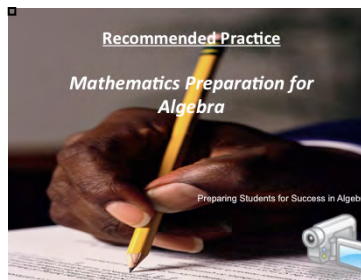
Ask:

What were some of the trends identified?

Did Bradley Witzel say these trends were specific to Montana or common across the United States? (*Common across the U.S.*)

Media: Bradley Witzel-MRI 2010-Clip #5 (4:50 min.)

Handout: None



Preparation: Download media

Say: The first recommended practice of Critical Foundations for Algebra is mathematics preparation for algebra.

Prepare students for algebra by developing a focused, coherent progression of key topics and skills leading to proficiency.

Students who develop a strong understanding of key mathematics concepts and procedural fluency, and can use these competencies to solve problems, are better prepared for entry into algebra.

Classroom instruction focused on the critical foundations for algebra helps students develop a conceptual understanding and procedural knowledge of whole numbers, fractions, decimals, percents, and proportional reasoning. Teachers can help students master these important skills by building automaticity with arithmetic facts; flexible, accurate, and automatic execution of standard algorithms; and practice in problem solving.


We're going to view a video to learn about the critical foundations needed to help all students become proficient in algebra and the importance of using a focused, coherent progression of key mathematics skills and topics in the elementary and middle years.

As you watch this video write down on a sticky note or a piece of paper concepts that you want to learn more about or components that your school needs to address.

Media: Preparing Students for Success in Algebra-multimedia overview (8:02 min.)
Handout: None

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Key Concepts



- Develop students' conceptual understanding and procedural knowledge of whole numbers, fractions, decimals, percents, and proportional reasoning and problem solving.
 - Classroom instruction must focus on the foundational topics of whole numbers and especially fractions. Students need to develop conceptual understanding and procedural knowledge to be successful at problem solving, and experience a mix of problem types and procedures to become proficient.

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Preparation: Caution! Do not read all of this slide.

Say:

When we begin investigating the first recommended practice, Mathematics Preparation for Algebra, we need to discuss some key concepts.


Develop students' conceptual understanding and procedural knowledge of whole numbers, fractions, decimals, percents, and proportional reasoning and problem solving.

Continue to read the rest of the slide to yourself-please give me a thumbs up when you are finished reading.

Media: None

Handout: None

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Key Concepts 

- Develop automatic recall of arithmetic facts, fluency with standard algorithms, and number sense.
- Students must develop number sense and become fluent with whole numbers and fractions to be successful in mathematics. Teachers need to provide students with ample opportunities to develop automatic recall of facts, which provides a foundation for learning fractions, and competence with algorithms so they can solve problems quickly and efficiently.

Office of Number, Operations, and Algebraic Thinking

Preparation: None

Say:

Another key concept is: develop automatic recall of arithmetic facts, fluency with standard algorithms, and number sense.

Think about how teachers can provide students with ample opportunities to develop automaticity of fact recall.

Write down ideas on a sticky note-I' ll give you 30 seconds to list as many ways you can think of. (at the end of 30 sec. say "stop")

Now, with your right shoulder partner I want you to share your ideas of how to give students practice opportunities with fact recall. (*Allow 1-2 min.*)


Media: None

Handouts: None

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Key Concepts

- Build student understanding of the commutative, distributive, and associative properties and address topics of geometry and measurement that are relevant to algebra.
 - Along with developing fluency with whole numbers and fractions, students must be able to understand the commutative, distributive, and associative properties as they master the mathematical operations of addition, subtraction, multiplication, and division. Teachers should focus some part of instruction on geometry; in particular, similar triangles and measurement.



Preparation: None

Say:

We are going to use an engagement strategy called “Tell, Add, Check”

Here’s how it works:

Partner 1 will **Tell** everything they remember about what they read.

Partner 2 will **Add** by filling in or clarifying information.

Both partners will **Check** and see if responses are correct-by referring to the slide.

With your left shoulder partner decide who is partner 1 and partner 2. Partner 1 is the one with the shortest hair for this exercise.

Now you’re going to read this slide to yourself. When you are finished you’re going to “Tell, Add, Check” with your partner. (*allow 3 min.*)

Media: None

Handout: None

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Learn What Works

Dr. Fennell

- *The Critical Foundations*
- *Benchmarks as Guideposts*
- *Professional Development for the Critical Foundations*

 National Center of Public Improvement



Preparation: Download media/handout

Say:

The key concepts along with some video we are going to watch detail the key concepts of this first practice recommendation: Mathematics as Preparation for Algebra.

Say:

We will be watching some clips of Dr. Fennell, a member of the National Mathematics Panel. Please take out Handout #2 to jot down key concepts from the videos or discussion points they may raise.

In this first clip Dr. Fennell discusses the critical foundations, provides a detailed explanation of each of the essential skills and examples, describes the progression of skill development, and talks about why it's important for students to understand how mathematics works. (8:49 min.)

In this next video, Dr. Fennell describes the development of the benchmarks and how schools can use these as guideposts in establishing standards, curriculum frameworks, and assessments focused on student mastery of foundational concepts and skills. (5:33 min)

In this last video Dr. Fennell addresses the importance of focusing professional development on mathematics content and providing teachers with a deep understanding of the critical foundations, including teaching fractions, and instruction that fosters understanding, proficiency, and the ability to solve problems. (6:02 min)

I know this was a lot of video to view at one time, however, the message from Dr. Fennell clearly describes Mathematics as Preparation for Algebra-the first practice recommendation.

Let's use our response cards to take a quick poll. Remember to wait for my hand drop before you share your response.

Show me how many of you feel you have a deep understanding of the critical foundations?

Show me how many of you feel like your school may need to problem solve how to gain a deeper understanding of the critical foundations?

Media: *The Critical Foundations* (8:49 min.)

Benchmarks as Guideposts (5:33 min.)

Professional Development for the Critical Foundations (6:02 min.)

Handout: Dr. Fennell Video Response Sheet

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See How it Works

- Focus on Key Topics
- Number Sense
- Fractions, Decimals, Percents



Preparation: None

Say:

Focus on Key Topics, Number Sense, along with Fractions, Decimals, and Percents will be examined to address the first practice recommendation of the National Mathematics Panel: Mathematics Preparation for Algebra.

Media: None

Handouts: None

Focus on Key Topics



- MT K-12 Mathematics Content Standards

<http://www.opi.mt.gov/pdf/Standards/10MathConStds.doc>

- What are Montana's key topics?
- Pacing Guides for Pre-Algebra and Algebra I
 - Describe the features of a pacing guide.
 - How might a pacing guide be useful?

Office of Public Instruction

Preparation: Download handouts

Say: We've all heard probably that mathematics instruction in the United States is an inch deep and a mile-wide.

Let's use our response cards to show if you agree with that statement or disagree with that statement. (*Wait-Signal*)

I want you to **Think-Write-Pair-Share** what is both good about an inch deep and a mile-wide and what's not good about that statement. Take a piece of paper or a sticky note and make a t-chart. You can put a + sign for the pros on one side and a – sign for the cons on the other. As you **think** about the statement **write** down your ideas in the appropriate side. (*Allow 1-2 min.*)

Now, **pair** with a neighbor to share your pros and cons. (*Allow 1-2 min.*)

Ask: What did you and your partner come up with? (*ask a few partnerships to share*)

We're going to review some resources to start discussing focusing on key topics. Please take out Handout #3 :*MT K-12 Mathematics Content Standards*. Notice you have only page 20 of this document. Of course, most of you have these already in your buildings. You can also download them at the URL listed on the slide.

Also, take out Handout #4:*Pacing Guides for Pre-Algebra and Algebra I*. These examples of pacing guides are used for Pre-Algebra and Algebra I courses at a middle school. The guides show the standards and objectives to be taught each week of the school year and include major benchmark assessments that are built into the plan.

Take a few minutes to review each of these handouts.

As you review these two handouts consider: What are Montana's key topics, what are the features of a pacing guide, and how might a pacing guide be useful?

These are your resources so feel free to highlight or make notes on them. (*Allow 4-5 min.*)

Lead a discussion

Ask: What are Montana's key topics?

How might a pacing guide be useful?

(*Use response cards*): Do any of you use a pacing guide at your school?

Take out Handout #5: Unwrapping Mathematics Standards from Doing What Works

I just want to point out this resource. I'll point out a few things on page two of this handout as a quick summary. (Point out highlighted items)

This is a good resource when you are considering key topics and making them understandable and measurable.

Now, we are going to watch a video clip from the Doing What Works website: A district mathematics coordinator explains how and why the New Haven School District moved toward a more focused K-12 mathematics curriculum and discusses their philosophy of preparing students for STEM careers.

Listen for his description of STEM careers and consider how or if you currently prepare your students for STEM careers.


Ask: What are STEM careers? (*Science-Technology-Engineering-Mathematics*)

How are we currently preparing students for STEM careers?

Media: *District Perspective on Focused Curriculum* (5:47 min.)

Handouts: MT K-12 Mathematics Content Standards (page 20)
Pacing Guides for Pre-Algebra and Algebra I (DWW)

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Number Sense 

- The term "number sense" is a relatively new one in mathematics education. It is difficult to define precisely, but broadly speaking, it refers to "a well-organized conceptual framework of number information that enables a person to understand numbers and number relationships and to solve mathematical problems that are not bound by traditional algorithms" (Bobis, 1996).
- The National Council of Teachers identified five components that characterize number sense: number meaning, number relationships, number magnitude, operations involving numbers, and referents for numbers and quantities. These skills are considered important because they contribute to general intuitions about numbers and lay the foundation for more advanced skills.

Adapted from: National Council of Teachers of Mathematics

Preparation: Download media/handouts

Say:

Remember we are investigating the first practice recommendation: Mathematics Preparation for Algebra. We just examined focusing on key topics and now we will begin to examine number sense.

(Read Slide)

Let's watch a video, *Preparation for Algebra*, of how a seventh-grade teacher uses a pre-algebra lesson to illustrate important skills, including number sense, students need to master in preparation for an algebra course. The teacher talks about the focus on graphic representation of numeric data in the lesson, and addresses key pre-algebra year topics such as fractions, ratios and proportions, and geometry. As you watch this video write down steps or components to her lesson with regard to number sense.

Now, let's watch a presentation, *Developing Number Sense in Kindergarten* at the other end of the spectrum. Again, with number sense being the focus.

Watch this presentation to see how a lesson on decomposing whole numbers is used to teach number sense to kindergarten students.

Think-Pair-Share:

What are some commonalities that both lessons had? *(Allow 2 min.)*

You have in your handout section the game that was referred to in the Kindergarten presentation: The Missing Partner Game (Handout #6)

Take a look at the game.

This is a "Classroom Connection" for this module. Classroom Connections are essential pieces from each module that are designed for teachers to implement immediately into their classrooms. As a Classroom Connection you have the summary which was provided by Doing What Works and a printable game sheet that was created from the sample that you can take and use in your classroom.

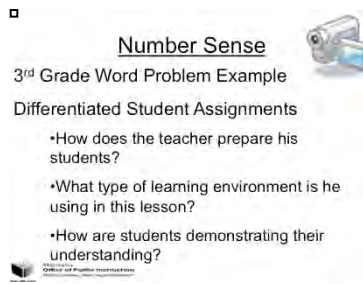
Media:

Preparation for Algebra-DWW (7:27 min.)

Developing Number Sense in Kindergarten -DWW (4:54 min.)

Handout:

The Missing Partners Game-DWW



Preparation: Download media

Say:

We've looked at number sense from a Kindergarten application to a seventh grade application. Now we're going to look at an example of a third grade level as well as applying number sense to word problems. This teacher also discusses how he differentiates student assignments.

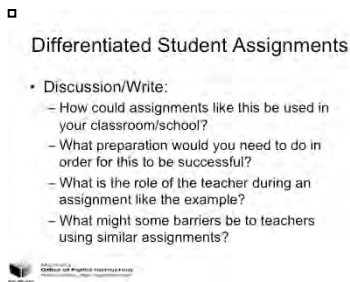
Watch this presentation to learn how a set of leveled word problems is used to check for student understanding of number and basic operations.

As you watch the presentation take notes to share with a partner after the video based on the following guide questions: How does he prepare his students? What type of learning environment is he using for this lesson? How are students demonstrating their understanding?

With a partner discuss the questions posed before viewing the video. Refer back to your notes you took. *(Allow 3-4 min.)*

Media: *Using Word Problems to Teach Number Sense (4:34 min.)*

Handout: None



Preparation: Download handout, provide a piece of chart paper for each table, provide a large tip marker to write on the chart paper for each table group, and at each table have some manipulative to use as “talking chips” –candy, poker chips

Say:

In the middle of your tables there are (say what manipulative you are using for talking chips). I want you to each take 4 and these will be used to aid in discussions. Within your group you will each need to share ideas concerning the four questions on the slide. Each time you share, place a talking chip back in the middle of the table. This is a way to assure each person speaks and that one person doesn't do all of the talking. This strategy can be used in meetings and classrooms.

Now, let's take our Handout #7: Differentiated Student Assignments. This is a resource from Doing What Works. As you saw in the video these are the examples of the assignments the students were working on.

These open-ended assignment sheets show the same task at three different levels of difficulty assigned to small groups of third-grade students.

Review this handout with your table and begin a discussion using the questions from this slide. We will work on reviewing the handout and discussing for about 10 minutes. At the end of the 10 minutes please write down notes from your table's discussion on the large chart paper with the large marker provided. These will then be posted on the wall.

Media: None

Handout: Differentiated Student Assignments-DWW

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Fractions, Decimals, Percents

- Expert Interview: Dr. Wu: Teaching Fractions
 - Reflect how you currently teach fractions and how Dr. Wu is describing the teaching of fractions.
- Using Multiple Representations to Teach Fractions
 - Keep track of those described in the video



Preparation: Download media

Say:

Our first video on the topic of fractions is Dr. Wu who discusses the importance of teaching fractions as abstract objects, familiarizing students with symbols, in preparation for algebra. (5:01 min)

As you watch, reflect on your current strategies to teach fractions.

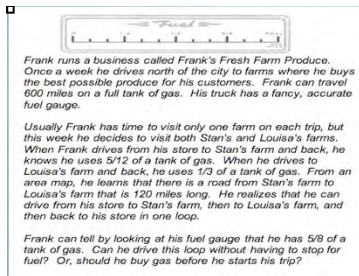
Next, you will hear elementary and middle school teachers explain different ways to use multiple representations, including manipulatives, visual representations and technology, to provide numerous learning situations to help students develop a conceptual understanding of and fluency with fractions.

Keep track of the many different ways the teachers describe. We'll check to see how many you can list after viewing the slideshow. (*show video Using Multiple Representations to Teach Fractions* (8 min.)) At the beginning of each slide there is time for you to read or for participants to read the text to the right of each slide.

Media: Teaching Fractions (Dr. Wu)-DWW (5:01 min.)

Using Multiple Representations to Teach Fractions-DWW

Handout: None



Preparation: Download handout: Frank's Fresh Farm Produce, have chart paper and large tip marker available

Say:

Read through this math problem that the third graders in the last video worked on. *(Allow 1-2 min.)*

We are going to **Think-Write** about this word problem. On a piece of paper write "background knowledge," *(Model this on chart paper)* "math skills," and "ways to represent"

Now, read through the problem again with those topics in your mind. Record what background knowledge a student would need to have in order to successfully solve this real life problem.

Record what math skills will be necessary to use to solve this problem and write down how students could represent this problem and solution. *(Allow 5-6 min.)*

Now, I want you to **pair** with a partner from a different table-someone you've not partnered with today what you wrote down. Add to your lists any information you may have missed that your partner shared. *(Allow 5 min.)*

Share *(Go to your prepared chart paper and write down participants' ideas-5 min.)*

Ask: What background knowledge would a student would need to have in order to successfully solve this real life problem? *(Write down ideas-reinforce or restate so the whole group hears responses)*

Ask: What math skills would be necessary to use to solve this problem? *(Write down ideas-reinforce or restate so the whole group hears responses)*

Ask: How might a student represent the work and solution to this math problem? *(Write down ideas-reinforce or restate so the whole group hears responses)*

As you probably concluded this is a pretty complex math problem, but one that students can do successfully.

Now, let's take a look at Handout #8: Frank's Fresh Farm Produce.

Look at the last page and you can see some examples of how third grade students showed their work and solutions to this problem. Take a minute to review the solutions and then discuss at your tables what you notice about the student's work.


Ask: Did we miss anything on our chart paper in terms of background knowledge, math skills, or ways to represent the work and solution?

Media: None

Handout: Frank's Fresh Farm Produce-DWW

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Using a Number Line

- Bradley Witzel from the Montana Reading Institute 2010 
- What background knowledge would a student would need to have in order to successfully solve these problems?
- What math skills would be necessary to use to solve these problems?

Montana Reading Institute
Division of Public Instruction

Preparation: Download Handout #9: Using a Number Line

Say:

We are going to look at a sample problem for seventh grade math students. Take out Handout #9: Using a Number Line.

See this assignment for working with fractions and decimals on a number line that asks middle school students to graph numbers on the number line, provide explanations for their solutions, and compare their number line with a partner.

Take a few moments to read through the handout and then discuss with your table the questions on the slide. *(Allow 5 min.)*


Let's watch a short clip of Bradley Witzel as he demonstrates manipulatives to understand addition and subtraction using positive and negative numbers. *(4 min.)*

Show me with your response cards, when I drop my hand, if you plan on using the open number line or the double open number line. *(Wait-Signal)*

Media: Bradley Witzel-MRI 2010-Clip #16 (3:56 min.)


Handout: Using a Number Line-DWW

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 Do What Works

- Review current standards against NMP benchmarks.
- Learning Together About Mathematics Preparation for Algebra
- Planning Template #3: Working With Schools

Montana K-12 Mathematics Content Standards
<http://www.opi.mt.gov/pdf/Standards/10MathConStds.doc>

 Montana Department of Public Instruction

Preparation: Download Handouts and have the full National Mathematics Advisory Panel Report available for viewing/showing

Say:

Now that we've learned about Mathematics Preparation for Algebra and we saw what works we can now look at Doing What Works.

This section we will look at some resources for you to use in your school district.

Take out Handout #10: Benchmark Review. The purpose of this resource is to check the congruence between the benchmarks recommended by the National Mathematics Advisory Panel and the standards, curriculum, and assessments currently in use in the district.

Handout #11: National Mathematics Panel Report page 42 is used with this resource so it has been provided in your handouts as well.

This tool can guide your assessment of the degree of congruence between the benchmarks recommended by the National Mathematics Advisory Panel and the standards, curriculum, and assessments currently in use in the district.

Spend just a few minutes reviewing this document. *(Allow 2 min.)*

Say:

The next resource is Handout #12: Learning Together About Mathematics Preparation for Algebra.

Use the steps and worksheet in this tool to guide district and school mathematics leaders about the major messages of the National Mathematics Advisory Panel report and systematically consider implications for system-wide changes.

Again, spend just a few minutes reviewing this document. *(Allow 2 min.)*

Say:

The last resource we'll review for the first practice of this module is Handout #13: Planning Template #3: Working With Schools.

This planning tool will be revisited as we progress through all three of the recommended practices of this module, Critical Foundations for Algebra.

Let's take a look at this planning template and spend just a few minutes reviewing the resource. *(Allow 2-3 min.)*

Ask:

How might a tool like this be useful?

Media: None

Handouts: Benchmark Review-DWW

National Mathematic Panel Executive Summary (82 total pages) Copy only page 42

Learning Together About Mathematics Preparation for Algebra-DWW

Planning Template #3: Working With Schools-DWW



Preparation: Download media and handout

Say: The second recommended practice of Critical Foundations for Algebra is Comprehensive Instruction. The recommended Comprehensive Instruction practice is based on research evidence cited in the National Mathematics Advisory Panel Final Report and, in particular, the Task Group Reports on *Learning Processes* and *Instructional Practices*.

The *Learning Processes Task Group's* research review showed that computational proficiency with whole number operations is dependent on sufficient and appropriate practice to develop automatic recall of addition and related subtraction facts, and of multiplication and related division facts. It also requires fluency with standard algorithms for addition, subtraction, multiplication, and division. Additionally, it requires a solid understanding of core concepts, such as the commutative, distributive, and associative properties.

Although the learning of concepts and algorithms reinforce one another, each is also dependent on different types of experiences, including practice. As with learning whole numbers, the Task Group found that a conceptual understanding of fractions and decimals and the operational procedures for using them are mutually reinforcing.

Research on students' abilities to solve fraction problems indicated that conceptual knowledge broadly determines performance in such tasks as estimation, word problems, and even computation.

We need to provide instruction that develops conceptual understanding, computational fluency, and problem-solving skills.

To prepare students for algebra, the mathematics curriculum must simultaneously develop conceptual understanding, computational fluency, and problem-solving skills.

The development of these concepts and skills is intertwined, each supporting the other and reinforcing learning.

Teachers can help by providing students with sufficient practice distributed over time and including a conceptually rich and varied mix of problems to support their learning.

In addition, teachers should encourage and support students in their efforts to master difficult mathematics content.

Students who believe that effort, not just inherent talent, counts in learning mathematics can improve their performance.

We're going to watch a video, *Developing Conceptual Understanding, Fluency, and Problem Solving*, to learn about the value of simultaneously teaching concepts, procedures, and problem solving; the importance of practice distributed over time in developing automaticity and improving fluency, including the use of technology-based tools; and the relationship between student beliefs about learning and mathematics performance.

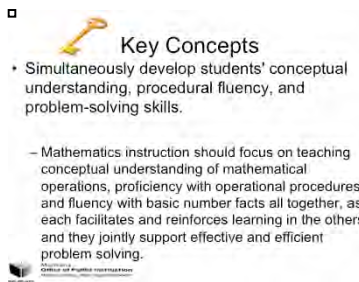
As you view this video use Handout #14 is a transcript of the video we will use it to guide us through the video. You can highlight as you watch the video to note important concepts or points to remember.

Ask:

What important concepts did you highlight? (*Allow 1 min.*)

Media: *Developing Conceptual Understanding, Fluency, and Problem Solving* (8:37 min.)

Handout: Transcript for video *Developing Conceptual Understanding, Fluency, and Problem Solving*



Preparation: Optional: stopwatch for 30-15-5

Say:

We'll be using an engagement strategy called "30, 15, 5"

Here's how we use this strategy-which, by the way, is a fantastic strategy to use with students:

Partner 1 speaks for 30 seconds, partner 2 speaks for 15 seconds, and then, lastly, partner 1 sums it up for 5 seconds.

Everyone please stand up and partner with someone you've not yet partnered with. Stand next to that person.

Partner 1 is the person who is tallest and Partner 2 is the shorter partner.

Keep standing and read the slide to yourself carefully because you are going to discuss the information with your partner. Give me a thumbs up when you are ready finished reading.
(Allow 1 min.)

Now, when I say "go" partner 1 summarizes the information on the slide, when I say "switch" partner 2 adds information, when I say "sum it up" partner 1 summarizes.

Ready? Go!

Media: None

Handout: None

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Key Concepts

- Provide adequate practice opportunities to develop fluency with arithmetic facts and standard algorithms.
- Teachers should provide practice that is distributed over time and includes a conceptually rich and varied mix of problems to help students develop fluency with facts and proficiency in operations, conceptual understanding, and problem solving.

Mathematics
Division of Student Improvement

Preparation: None

Say:

Another key concept is: provide adequate practice opportunities to develop fluency with arithmetic facts and standard algorithms.

Teachers should provide practice that is distributed over time and includes a conceptually rich and varied mix of problems to help students develop fluency with facts and proficiency in operations, conceptual understanding, and problem solving.

On a sticky note write down as many ways to provide practice opportunities to develop fluency with arithmetic facts and standard algorithms. Let's see how many you can write down in 1 min.

Share your ideas with your table. Each person tell one practice opportunity and then move around the table adding one more at a time until you've exhausted your lists. (*Allow 3-5 min.*)

Media: None

Handout: None



Preparation: Download media

Say:

The key concepts along with some video we are going to watch detail the key concepts of this second practice recommendation: Comprehensive Instruction.

Dr. Ferrini-Mundy discusses the interrelations between conceptual understanding, computational fluency, and problem-solving skills.

She suggests ways to plan lessons and units.

She also addresses the role of teacher wisdom and judgment and recommends ways that schools and districts can support teachers.

She also talks about the impact of student beliefs about effort on mathematics achievement. (7:08 min)

As you watch and listen to Dr. Ferrini-Mundy write down critical concepts about lesson focus, what schools can do, and about student motivation. Listen carefully to her speak to the teacher's role in student motivation. (*Show video*)

Say:

Tell me about the lesson focus: (*Allow for discussion, but if participants aren't volunteering then use the response cards or specific people*)

Does every lesson need to include computational fluency, conceptual understanding, and problem solving? (*No, but each unit of study should include all three of these*)

Facilitate discussion: (*Allow 5-8 min.*)

What can schools do?

What did she say about student motivation?

What did she share about the teacher's role in student motivation?

Media: Simultaneously Teaching Conceptual Understanding, Computational Fluency, and Problem-Solving Skills-DWW (7:08 min.)

Handout: None



See How it Works

- Conceptual and Procedural Understanding
- Effort and Persistence

Missouri
Office of Public Instruction



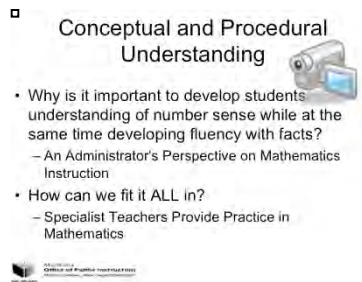
Preparation: None

Say:

Let's see how it works. We'll be discussing conceptual and procedural understanding along with effort and persistence.

Media: None

Handout: None



Preparation: Download media/handout

Ask:

Why is it important to develop students understanding of number sense while at the same time developing fluency with facts? *(Allow 1-2 min.)*

Say:

In this video an elementary school principal discusses the role of number sense in transitioning to algebra and explains why it is important to develop students' understanding of number sense while at the same time developing fluency with facts. *(4:49 min.)*

In your handout section please find Handout #15: Physical Education Lessons for Mathematics Practice. This is a packet of lessons compiled by physical education teachers in grades 3-8 that address the district's mathematics standards and integrate math concepts and practice opportunities into their classes.

What a way for districts to work together and share the responsibility of the curriculum!

Media: An Administrator's Perspective on Mathematics Instruction-DWW (4:49 min.)

Handout: Physical Education Lessons for Mathematics Practice-DWW



Preparation: download media/handouts

Say:

Effort and persistence matters in math! Students need to understand and accept that some problems will require more stamina and persistence while other problems will not. In either problem the students need to be supported in maintaining stamina and building persistency.

In these next two videos student effort and persistence will be addressed.

The first of the videos elementary school teachers discuss and demonstrate strategies they use to encourage students to apply effort to learning mathematics and describe ways that they communicate with parents and the messages they give to parents about the importance of effort.

In the second, middle school administrators and teachers describe structures and systems that build students' stamina for working on mathematics challenges, including components such as lesson structure and modeling, peer learning, parent communication, and establishing a "culture of no failure."

As we view both of these, please complete the video response sheet which is Handout #16: Effort and Persistence Video Response Sheet which you can find in your handout section of your materials.

(View videos)

Say:

Let's take just a few minutes to complete any part of the response sheet you may have left and complete the self reflection part at the bottom. What are those practices that you currently do to build on effort and stamina, how do you currently communicate that with your students and parents? Further, what are some strategies that you heard from the videos that you might like to implement; how will you communicate that with your students and parents? (Allow 3-4 minutes)

In your handout section please find Handout #17:Principal's Message to Parents About Effort

You'll see three sample issues of Madison's *Monday Messenger*, a weekly parent newsletter from the principal, and can read feature articles related to the importance of effort and persistence in mathematics, including the influence of adult modeling on student attitudes, the importance of effort and struggle in learning complex skills, and assisting and supporting children without simply providing answers.

Take a few minutes to review this document. You may want to highlight or otherwise mark parts of the message you could use with your parents. (Allow 2-3min. to review)

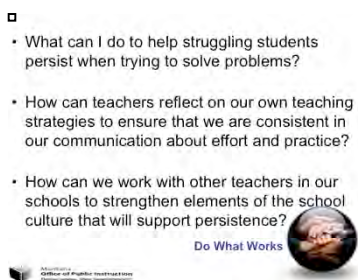
At your tables discuss how you can share this message with your parents. Do you feel that a message like this is even necessary? (Allow 4-5 min.)

Media: Messages on Effort and Persistence-DWW (8 min.)

Stamina, Effort, and Success-DWW (6 min.)

Handout: Effort and Persistence Video Response Sheet

Principal's Message to Parents About Effort-DWW



Preparation: download handouts

Ask:

What can we do to help struggling students persist when trying to solve problems?

We must explicitly teach children and their parents that with effort, hard work, and persistence, students can make gains in mathematics.

Sharing with students and their parents the connection between a student's attitudes about learning and mathematics performance can help to develop a persistent attitude.

What we say, how we say it, and our beliefs in each student achieving will impact students' perceptions and willingness to attempt problems and persistency in solving problems.

We can use the handout, Principal's Message to Parents About Effort, we just looked at to help share our message with parents and students alike.

Ask:

How can teachers reflect on our own teaching strategies to ensure that we are consistent in our communication about effort and practice?

Handout #18: Reflecting on Strategies to Build Effort and Persistence is a tool that teachers can use to think about the various aspects of their practice that contribute to developing beliefs that focus on effort and to building students' stamina or willingness to persist with challenges in learning mathematics.

Let's take a look at this handout. (Allow 3-4 min.)

Ask:

•What do you notice?

•How might this be beneficial?

•How could something like this be used in grade level discussions and school level discussions?

Ask:

How can we work with other teachers in our schools to strengthen elements of the school culture that will support persistence? (Allow 2-3 min.)

A tool we can use to address this question is Handout #19: Learning Together About Comprehensive Instruction.

This professional development activity can be used to engage Pre-K-8 teachers in discussions of common issues that arise in mathematics instruction. The approach could be used for a cross-grade level professional development.

Coaches and professional developers can use the next handout as an observation tool to focus classroom observations and structure discussions during feedback conferences. The tool focuses on instructional practices discussed in the National Mathematics Advisory Panel report.

This is Handout #20: Comprehensive Instruction Observation and Feedback

Take a minute to review this document. (Allow 1 min.)

This can also be used by teachers to see what needs to be present or to use if they had video taped themselves as a tool to critique their own teaching.

As with our first practice of this module we can use the Planning Template #3: Working with Schools to assess and plan improvement of our mathematics program. (Hold your copy up)

Let's take out again Handout #13: Planning Template #3: Working with Schools now that we have completed the first two practices of Critical Foundations for Algebra. Work with your school colleagues and go over this tool. I'll give you about 5 minutes to discuss your needs. Ask yourselves what are our immediate needs that require attention?

Media: None

Handouts:

Reflecting on Strategies to Build Effort and Persistence-DWW

Learning Together About Comprehensive Instruction-DWW

Comprehensive Instruction Observation and Feedback-DWW

Planning Template #3: Working with Schools-DWW



Preparation: Download media. Write on chart paper or a white board the headings detailed in the overview section of these notes

Say: The third and last recommended practice of Critical Foundations for Algebra is Mastery Framework.

The benchmarks for the critical foundations proposed by the National Mathematics Advisory Panel should be used to guide the development of state frameworks, state assessments, and district and school math programs to ensure that students learn critical skills and concepts.

We're going to watch an overview of the practice, Mastery Framework. We're going to learn about the components of a mastery framework, including clearly stated benchmarks, regular and ongoing formative assessments, and differentiated instruction to address all students' needs.

Before we watch the overview please take out a large piece of paper. Point to the prepared chart paper or white board headings for participants to copy onto their paper. Write the question "What is a mastery framework?" at the top and leave some space for notes

Then write: Formative Assessment

Below that write: Explicit Instruction

Then write: Representations

Lastly write the question: How do we support mathematically gifted students? (Allow 2-3 min.)

Now we will watch the overview and I want you to take notes and write answers to the questions you wrote on your paper. (show video-8:27 min.)

Say:

Schools can improve student learning by conducting regular formative assessment linked to the benchmarks and then using the results to monitor students' progress towards proficiency and individualized instruction.

Students who struggle with mathematics can improve their learning through explicit classroom instruction that includes clear models for solving problems using an array of examples, extensive practice in the use of newly learned strategies and skills, and specific feedback.

Gifted students benefit from instruction that is differentiated (by level, complexity, breadth, and depth), developmentally appropriate, and conducted at a rapid rate.

Say:

I want you to **Think**: What are your current ways you organize formative assessment results? Now, **pair** with your neighbor to share those ways to organize the results of your formative assessments. (Allow 2-3 min.)

Think: How do teachers analyze those results currently in your school? **Pair** with the same neighbor to discuss how results are currently being analyzed. (Allow 2-3 min.)

Let's **share** what you discussed with your partners. (Restate the questions and call on a few individuals-not those who raise their hand)

Media:
Handout: None

□

Key Concepts



- Establish benchmarks based on the Critical Foundations for Algebra to systematically gain mastery of key topics.

— District and school benchmarks, curriculum, and assessments should be aligned with the benchmarks for the critical foundations and mastery points recommended by the National Mathematics Advisory Panel to ensure that instruction focuses on essential skills and topics and student learning proceeds at an effective pace.

CRITICAL FOUNDATIONS FOR ALGEBRA

Preparation: Caution! Do not read all of this slide.

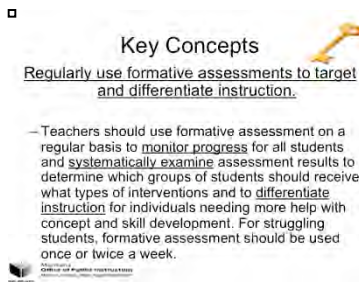
Say:

When we begin investigating the third recommended practice, Mastery Framework, we need to discuss key concepts.

Read this slide to yourself looking up at me when you are finished.

Media: None

Handout: None



Preparation: Optional: stopwatch for 30-15-5

Say:

We'll be using an engagement strategy called "30, 15, 5"

Here's how we use this strategy-which, by the way, is a fantastic strategy to use with students:

Partner 1 speaks for 30 seconds, partner 2 speaks for 15 seconds, and then, lastly, partner 1 sums it up for 5 seconds.

Everyone please stand up and partner with someone you've not yet partnered with. Stand next to that person.

Partner 1 is the person who is tallest and Partner 2 is the shorter partner.

Keep standing and read the slide to yourself carefully because you are going to discuss the information with your partner. Give me a thumbs up when you are ready finished reading.
(Allow 1 min.)

Now, when I say "go" partner 1 summarizes the information on the slide, when I say "switch" partner 2 adds information, when I say "sum it up" partner 1 summarizes.

Ready? Go!

Media: None

Handout: None

□

Key Concept



Use a combination of instructional methods for students experiencing mathematical difficulties, including explicit instruction, multiple representations, and additional materials



Michigan
Office of Public Instruction
2014-2015

Preparation: None

(Read Slide)

Media: None

Handout: None

□

Regular, explicit methods of instruction help students in the performance of computations, solving word problems, and solving problems that require the application of mathematics to novel situations.

This time should be dedicated to ensuring that students possess the foundational skills and conceptual knowledge necessary for understanding the mathematics they are learning at their grade level.



Preparation: None

Say:

We' ll read this slide together using the engagement strategy "Cloze Reading." How this is done is I will read, when I pause you read the next word. I will then continue reading and whenever I stop you read the next word.

Ready? (*Start Cloze Reading*)

Media: None

Handout: None



Preparation: None

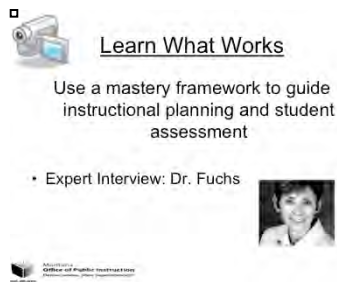
Say:

Differentiate instruction for mathematically gifted students is our last key concept for this third practice Mastery Framework.

Read the remainder of the slide to yourself.

Media: None

Handout: None



Preparation: Download media

Say:

Listen to Dr. Fuchs as she explains the two purposes and types of formative assessment, addresses issues with the different approaches, and contrasts two types of objective formative assessment.

She also talks about optimal ways for teachers to use formative assessment data, the usefulness of computers in managing systematic assessment data, and the need for professional development in this area. (8:26 min)

Ask:

What was a statement or idea that struck a cord with you as you watched this video? (*Allow 2-3 min.*)

Media: Formative Assessment-DWW (8:26 min.)

Handout: None



Preparation: Download media

Say:

Dr. Fuchs is going to be explaining the design features of researched-based instructional programs. These are the six design features she discusses. *(Read the six features)*

Listen for these design features and what Dr. Fuchs says about each one.

You may want to write these six features down and make notes next to each as you view the video.

Media: Research-Based Instructional Programs-DWW (8:38 min.)

Handout: None

□

See How it Works

- Benchmarks for Mastery
- Formative Assessments
- Working with All Students:
Struggling and Accelerated

Mississippi
Office of Public Instruction
www.doe.ms.gov



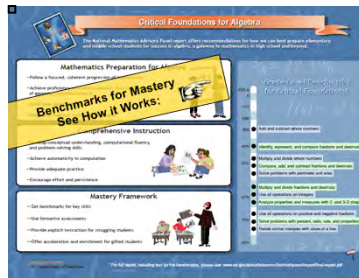
Preparation: None

Say:

Let's see how it works with benchmarks for mastery, formative assessments, and working with all students-those who struggle and those are accelerated.

Media: None

Handout: None



Preparation: None

Point out the Grade Level Benchmarks for Critical Foundations-read each benchmark and appropriate grade level

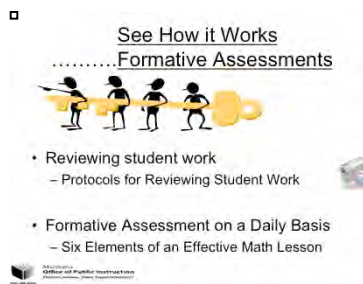
Say:

These benchmarks should guide the selection of curricula, the design of assessments, and the delivery of instruction.

These are the recommended benchmarks for the critical foundations of algebra. They are not intended to be the only topics addressed in the Pre-K through 8th Grade mathematics curriculum.

Media: Critical Foundations for Algebra Visual Diagram (embedded)-DWW

Handout: None



Preparation: Download media/handout. Have a chart paper and a large marker ready to use for recording.

Say:

We've already heard from Dr. Fuchs about formative assessment. Now, let's see teachers in action discussing student work in a roundtable discussion using set protocol for that discussion to take place. You have an example of protocol as Handout #21: Protocol for Reviewing Student Work.

Let's take a minute to review this handout so that we can follow along with the video and see the process these teachers are engaged in. *(Allow 1 min.)*

Now, let's watch the video and see this in action! *(7:22 min.)*

Say:

Make a t-chart on a sticky note. On one side write benefits and on the other write challenges.

Think about and **write** about what are some benefits and challenges to reviewing student work with colleagues? *(Allow 1-2 min.)*

Now, at your tables **share** the benefits and challenges you came up with. *(Allow 4-5 min.)*

Let's chart some of those benefits and challenges as a whole group now. *(Use chart paper and a large-dark marker to record ideas—Allow 2-3 min.)*

As we continue to explore formative assessments we're going to listen to Melissa Gardener who is a middle school teacher in Georgia. She shares how her school integrates informal formative assessments into their daily lessons, what is the Six Elements of an effective math lesson, and ideas like "tickets out the door." We have their example of the Six Elements of an Effective Math Lesson as well as the audio's transcript to aid us in our understanding of formative assessments. Please get out Handout #22: Formative Assessments on a Daily Basis transcript and Handout #23: Six Elements of an Effective Math Lesson

As we listen to Melissa use the transcript and highlight ideas or concepts that jump out at you—ideas to remember or ones that you'll want to follow up on. Use the handout of the Six Elements of an Effective Math Lesson as a visual to help understand and follow along with the practices they use in their district.

Media:

Reviewing Student Work-DWW (7:22 min.)

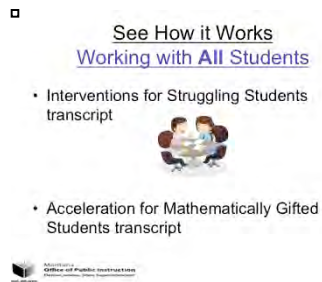
Formative Assessment on a Daily Basis-DWW (5:53 min.)

Handout:

Protocol for Reviewing Student Work-DWW

Six Elements of an Effective Math Lesson-DWW

Formative Assessment on a Daily Basis TRANSCRIPT-DWW



Preparation: Download Handouts

In your handout section of your materials you have two transcripts that we are going to use to learn collaboratively with a partner. Find both handouts. Handout #24: Interventions for Struggling Students Transcript and Handout #25: Acceleration for Mathematically Gifted Students.

In the Interventions for Struggling Students handout you will read what how a math department chair describes various intervention options for students who need additional support, including a four-tier pyramid of interventions, and explains the importance of moving students fluidly across intervention levels.

In the Acceleration for Mathematically Gifted Students handout you will read what how an experienced teacher of mathematically gifted students describes a program of accelerated mathematics courses for the middle school, including how students are identified for inclusion in the program, the program's emphasis on both acceleration and enrichment, and instructional approaches used in the program.

For this activity you will each read through one transcript. You may highlight or mark on this handout any points you'll want to be sure to teach your partner later. After each partner has read his/her transcript you will share what you learned.

So, choose who will read which transcript. (*Wait*)

Begin reading and highlighting. (Allow 5 min.)

Now, that each of you has had time to read a transcript I want you to share what you learned. (*Allow 8-10 min.*)

Now that you've shared with your partners let's share in a whole group setting.

Ask:

What is the critical information from the transcript *Interventions for Struggling Students*? (*Allow 4-5 min.*)

What is the critical information or points to consider from the transcript *Acceleration for Mathematically Gifted Students*? (*Allow 4-5 min.*)

Media: None

Handouts:

Interventions for Struggling Students Transcript-DWW

Acceleration for Mathematically Gifted Students Transcript-DWW

□



Do What Works

The Components of a Mastery Framework

- A checklist to aid staff to understand the key components of a mastery framework and to assess their school's progress toward implementing these components.



Massachusetts
Office of Public Instruction

Preparation: Download handout

(Read the slide)

Introduce activity:

Please take out Handout #26: The Components of a Mastery Framework. We will be looking this tool over by ourselves at first and then we will spend time in our teams discussing how we can use this tool as well as to assess the school's progress toward implementation.

So, take about 3 minutes to review this documents on your own. *(Allow 3 min.)*

Now, in school teams, review the tool to start setting up an action plan. *(Show the next slide)*

Media: None

Handout: The Components of a Mastery Framework-DWW

□ The Components of a Mastery Framework

Discuss in your teams:

- Which components are in place?
- Which components are partially in place?
- Which components are not at all in place?
- What are our priorities?
- Who are the persons responsible?




Preparation: None

Read the discussion points and allow time for participants to discuss and plan. (15-20 min.)
While groups are discussing walk around to guide/facilitate when necessary.

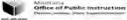
Media: None


Handout: The Components of a Mastery Framework-DWW

□

 Do What Works

- Working with Struggling Students
 - Self-Assessment Inventory
 - This tool has been designed to help teachers identify whether or not they are implementing all the practices that might help students who are struggling in mathematics.





Preparation: Download handout

We've learned about helping struggling students now let's look at a tool that has been designed to help teachers identify whether or not they are implementing all the practices that might help students struggling in mathematics.

Take out Handout #27: Self-Assessment Inventory: Working with Struggling Students.
(Show next slide)

Media: None

Handout: Self-Assessment Inventory: Working with Struggling Students-DWW

Classroom Instruction	
1. In small groups (3-5 students) to develop their own problem-solving strategies.	Group-work involving problem-solving (working with 3-5 students in problem-solving groups) to develop their own problem-solving strategies.
2. A classroom-wide activity to develop problem-solving strategies.	Classroom-wide activity to develop problem-solving strategies.
3. A classroom-wide activity to develop problem-solving strategies.	Classroom-wide activity to develop problem-solving strategies.
4. A classroom-wide activity to develop problem-solving strategies.	Classroom-wide activity to develop problem-solving strategies.
5. A classroom-wide activity to develop problem-solving strategies.	Classroom-wide activity to develop problem-solving strategies.
Classroom Instruction	
Student Practice	
1. A classroom-wide activity to develop problem-solving strategies.	Classroom-wide activity to develop problem-solving strategies.
2. A classroom-wide activity to develop problem-solving strategies.	Classroom-wide activity to develop problem-solving strategies.
3. A classroom-wide activity to develop problem-solving strategies.	Classroom-wide activity to develop problem-solving strategies.
4. A classroom-wide activity to develop problem-solving strategies.	Classroom-wide activity to develop problem-solving strategies.
5. A classroom-wide activity to develop problem-solving strategies.	Classroom-wide activity to develop problem-solving strategies.

Preparation: Download handout

Say:

As you review this resource note that it is divided into sections:

- Classroom Instruction
- Student Practice
- Formative Assessment
- Feedback & Communications
- Interventions & Additional Practice

Also, note that each section on the left side are statements. The right side are examples or strategies related to the statement on the left.

At the end of each section you will see a question for reflection and serves as an overall guiding question for the particular section of the self-assessment inventory.

Ask:


How might you use this?

How often could you use this type of tool? *(as often as desired by an individual, would be beneficial for the team to decide on how often uniformly across the school)*


Media: None

Handout: Self-Assessment Inventory: Working with Struggling Students-DWW

□

 Do What Works

- Working with Mathematically Gifted Students
 - This tool has been designed to help school mathematics leaders and teachers to reflect about how well they are implementing practices to engage and challenge students who are gifted in mathematics.



Arkansas Department of Education
Office of Public Instruction

Preparation: Download handout

Say:

School mathematics leaders and teaching staff can use this next self-assessment inventory to think about how well they are implementing practices to engage and challenge students who are gifted in mathematics.

Take a look at Handout #28: Working with Mathematically Gifted Students: School Inventory of Practices. (*Allow 3-4 min.*)

As you can see this inventory is divided into two sections: School and Teacher by asking “Has the school” or “as a teacher, have you...”

Think-pair-share: (*Allow 4-6 min.*)

What are some of the items that your school has addressed well?

What are some that need attention at your school?

What are some that you as a teacher need to focus attention on?

Media: None

Handout: Working with Mathematically Gifted Students: School Inventory of Practices-DWW

□  Do What Works—Planning Template

- What does your school have in place?
- What does your school need to put into implementation?
- How do we prioritize the needs and who will be involved (roles/responsibilities)?
- What is our timeline for the action plan items?



Office of Public Instruction

Let's take another look at Handout #13: Planning Template #3: Working with Schools. Now that we have completed all three of the practices of Critical Foundations for Algebra.


Work with your school colleagues and go over this tool in its entirety. I'll give you about 25 minutes to discuss with your team the guiding questions on the slide and will leave them up so you can refer back to them. (*Allow 25 min.*)

Media: None

Handout: Planning Template #3: Working with Schools-DWW

□ National Mathematics Advisory Panel

- “For all content areas, practice allows students to achieve automaticity of basic skills...which frees up working memory for more complex aspects of problem solving.”
- “Students learn by building on prior knowledge, extending as far back as childhood.”



Department of Education
Office of Public Instruction

Preparation: None

Say:

These are some quotes from the National Mathematics Advisory Panel...*(read them)*

Media: None

Handout: None

□

References/Resources

- Doing What Works: <http://dww.ed.gov/>
- National Mathematics Advisory Panel Final Report: <http://www2.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf>
- Montana Office of Public Instruction RtI http://opi.mt.gov/Resources/RTI/Index.html#gpm1_2
- Montana Office of Public Instruction Content Standards: <http://www.opi.mt.gov/Curriculum/Index.html>



Preparation: None

Say:

Much of the media and handouts for this training we made available from the website ***Doing What Works***

The Doing What Works website is a website dedicated to helping educators implement effective educational practices and includes practice guides developed by the U.S. Department of Education's Institute of Education Sciences.

No media
No handouts